Gunter, Jason

From: James, Kevin <kjames@doerun.com>
Sent: Tuesday, July 28, 2015 5:26 PM
To: Gunter, Jason
Cc: Yingling, Mark; Neaville, Chris; Montgomery, Michael; 'martin.kator@dnr.mo.gov'; 'brandon.wiles@dnr.mo.gov'; 'Ty Morris (TMorris@barr.com)'; Seabourne, Rocky
Subject: Federal Progress Report - June
Attachments: removed.txt; Federal_ProgressReport_06-15.pdf; Remediation Air Report - May 2015.pdf

Jason -

Attached is the June Progress Report for the Federal Site.

Best regards,

Kevin James

Kevin James
Construction Engineering
W: 573.626.2096
C: 573.247.6766

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40493211
Superfund

THE DOE RUN COMPANY

Remediation Group

Kevin James
Construction Engineering Manager
kjames@doerun.com

July 28, 2015

Mr. Jason Gunter
Remedial Project Manager
U.S. Environmental Protection Agency
Region 7 - Superfund Branch
11201 Renner Blvd.
Lenexa, KS 66219

Re: The Doe Run Company – Federal Mine Tailings Site Monthly Progress Report

Dear Mr. Gunter:

As required by Article XVII, Paragraph 73 of the Administrative Order on Consent (Docket No.VII-97-F-0009) for the referenced project and on behalf of The Doe Run Company, the progress report for the period June 1, 2015 through June 30, 2015 is enclosed. If you have any questions or comments, please call me at 573-626-2096.

Sincerely,

Kevin James
Construction Engineering Manager

Enclosure
c: Mark Yingling – TDRC (electronic only)
Chris Neaville – TDRC (electronic only)
Michael Montgomery – TDRC (electronic only)
Martin Kator – MDNR DSP
Brandon Wiles – MDNR HWP
Ty Morris – Barr Engineering

Federal Mine Tailings Site

Park Hills, Missouri

Monthly Progress Report

Period: June 1, 2015 – June 30, 2015

1. **Actions Performed or Completed This Period:**
   a. Work continued on the development of the Removal Action Report.
   b. Work continued on the design modifications to improve drainage in the northwest section of the Off-Road Vehicle (ORV) Riding Area.
   c. Given the nature of the work remaining at the site, The Doe Run Company would like to request a reduction in the frequency of the progress reports to quarterly. The next progress report that would be submitted for this site would be for July, August, and September.

2. **Data and Results Received This Period:**
   a. During this period, the ambient air monitoring samples for May were processed and the Ambient Air Monitoring Report for May 2015 was completed and is attached.

3. **Planned Activities for Next Period:**
   a. Address any comments received from MDNR-DSP to the Post-Removal Site Control Plan for the site.
   b. Continue developing the Removal Action Report.
   c. Continue the development of the design modifications to improve drainage in the northwest section of the ORV Riding Area.

4. **Changes in Personnel:**
   a. Kevin James has taken another position within The Doe Run Company and will no longer act as the Project Coordinator.
   b. Rocky Seabourne will now be the Project Coordinator for The Doe Run Company. In accordance with Section VII, Paragraph 42, of the above referenced Administrative Order on Consent this will serve as the written notice of the change in Project Coordinators.

5. **Issues or Problems Encountered and the Resolution:**
   a. None.

Monthly Ambient Air Monitoring Report

The Doe Run Company
Old Lead Belt Sites:
Federal, Rivermines, National, and Leadwood

May-2015

SUITE 300
1801 PARK 270 DRIVE
ST. LOUIS, MO 63146

Federal Site

Sample Results for **May-2015**

	St. Joe (Ballfields)		Big River#4		Water Treatment Plant	
Sample Date	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3
5/1/15	38	0.014	37	0.039	41	0.013
5/4/15	invalid	invalid	80	0.014	81	0.014
5/5/15	53	0.007	50	0.020	52	0.021
5/6/15	69	0.014	71	0.013	73	0.014
5/7/15	62	0.014	60	0.007	83	0.021
5/8/15	26	0.007	21	0.007	26	0.007
5/11/15	37	0.007	41	0.000	37	0.028
5/12/15	31	0.007	35	0.007	34	0.020
5/13/15	30	0.007	29	0.007	26	0.007
5/14/15	40	0.007	38	0.007	41	0.000
5/15/15	20	0.000	21	0.000	24	0.000
5/18/15	38	0.014	27	0.007	29	0.021
5/19/15	27	0.007	25	0.007	30	0.007
5/20/15	11	0.000	9	0.000	10	0.000
5/21/15	15	0.007	12	0.007	13	0.007
5/22/15	24	0.007	27	0.013	23	0.013
5/26/15	14	0.007	13	0.000	18	0.007
5/27/15	20	0.007	23	0.014	19	0.007
5/28/15	18	0.014	19	0.007	19	0.000
5/29/15	23	0.007	18	0.007	18	0.007

Monthly Avg. TSP	31	33	35
Monthly Avg. Pb	0.008	0.009	0.011
Apr-15	0.011	0.035	0.027
Mar-15	0.012	0.004	0.014
Rolling 3-Month	**0.010**	**0.016**	**0.017**

Three month rolling average must be less than 0.15 ug/m3

NOTES: St. Joe: 5/4, <23hr run time.

	Big River QA	
Sample Date	**TSP** ug/m3	**Lead** ug/m3
5/5/15	56	0.014
5/7/15	63	0.007
5/12/15	37	0.007
5/14/15	40	0.007
5/19/15	24	0.007
5/21/15	12	0.007
5/26/15	15	0.000
5/28/15	20	0.000

Rivermines

Sample Results for **May-2015**

	Big River #4		Rivermines South #1		Rivermines North #2		Rivermines East #3	
Sample Date	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3
5/1/15	37	0.039	invalid	invalid	42	0.014	41	0.013
5/4/15	80	0.014	78	0.014	74	0.063	81	0.014
5/5/15	50	0.020	56	0.014	57	0.091	52	0.021
5/6/15	71	0.013	71	0.007	65	0.056	73	0.014
5/7/15	60	0.007	72	0.014	56	0.049	83	0.021
5/8/15	21	0.007	invalid	invalid	28	0.007	26	0.007
5/11/15	41	0.000	37	0.014	34	0.049	37	0.028
5/12/15	35	0.007	50	0.086	36	0.027	34	0.020
5/13/15	29	0.007	27	0.020	28	0.007	26	0.007
5/14/15	38	0.007	35	0.007	38	0.042	41	0.000
5/15/15	21	0.000	invalid	invalid	23	0.007	24	0.000
5/18/15	27	0.007	57	0.225	29	0.000	29	0.021
5/19/15	25	0.007	31	0.060	28	0.000	30	0.007
5/20/15	9	0.000	33	0.196	invalid	invalid	10	0.000
5/21/15	12	0.007	21	0.067	12	0.000	13	0.007
5/22/15	27	0.013	invalid	invalid	23	0.021	23	0.013
5/26/15	13	0.000	16	0.000	36	0.091	18	0.007
5/27/15	23	0.014	16	0.007	23	0.042	19	0.007
5/28/15	19	0.007	20	0.000	18	0.007	19	0.000
5/29/15	18	0.007	invalid	invalid	25	0.049	18	0.007

Monthly Avg. TSP	33	41	36	35
Monthly Avg. Pb	0.009	0.049	0.033	0.011
Apr-15	0.035	0.060	0.019	0.027
Mar-15	0.004	0.019	0.013	0.014
Rolling 3-Month	**0.016**	**0.043**	**0.022**	**0.017**

Three month rolling average must be less than 0.15 ug/m3

NOTES: Rivermines South: all invalids were >25hr run time.
Rivermines North #2: 5/20, <23hr run time.

	Big River QA	
Sample Date	**TSP** ug/m3	**Lead** ug/m3
5/5/15	56	0.014
5/7/15	63	0.007
5/12/15	37	0.007
5/14/15	40	0.007
5/19/15	24	0.007
5/21/15	12	0.007
5/26/15	15	0.000
5/28/15	20	0.000

National Site

Sample Results for **May-2015**

	Big River #4		Ozark #1		Soccer Park #2		Water Treatment Plant	
Sample Date	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3
5/1/15	37	0.039	38	0.007	41	0.027	41	0.013
5/4/15	80	0.014	77	0.007	98	0.057	81	0.014
5/5/15	50	0.020	68	0.014	60	0.035	52	0.021
5/6/15	71	0.013	74	0.007	87	0.055	73	0.014
5/7/15	60	0.007	71	0.014	68	0.035	83	0.021
5/8/15	21	0.007	25	0.007	25	0.007	26	0.007
5/11/15	41	0.000	30	0.007	invalid	invalid	37	0.028
5/12/15	35	0.007	32	0.007	invalid	invalid	34	0.020
5/13/15	29	0.007	27	0.000	28	0.013	26	0.007
5/14/15	38	0.007	8	0.000	47	0.021	41	0.000
5/15/15	21	0.000	32	0.000	24	0.014	24	0.000
5/18/15	27	0.007	26	0.000	38	0.007	29	0.021
5/19/15	25	0.007	28	0.000	22	0.007	30	0.007
5/20/15	9	0.000	12	0.000	11	0.000	10	0.000
5/21/15	12	0.007	15	0.000	17	0.007	13	0.007
5/22/15	27	0.013	28	0.007	30	0.020	23	0.013
5/26/15	13	0.000	17	0.007	19	0.014	18	0.007
5/27/15	23	0.014	22	0.007	32	0.021	19	0.007
5/28/15	19	0.007	21	0.007	22	0.014	19	0.000
5/29/15	18	0.007	20	0.007	19	0.007	18	0.007

Monthly Avg. TSP	33	34	38	35
Monthly Avg. Pb	0.009	0.005	0.020	0.011
Apr-15	0.035	0.008	0.039	0.027
Mar-15	0.004	0.007	0.025	0.014
Rolling 3-Month	**0.016**	**0.007**	**0.028**	**0.017**

Three month rolling average must be less than 0.15 ug/m3

NOTES: Soccer Park #2: 5/11, >25hr run time, 5/12, <23hr run time.

	Big River QA	
Sample Date	**TSP** ug/m3	**Lead** ug/m3
5/5/15	56	0.014
5/7/15	63	0.007
5/12/15	37	0.007
5/14/15	40	0.007
5/19/15	24	0.007
5/21/15	12	0.007
5/26/15	15	0.000
5/28/15	20	0.000

Leadwood

Sample Results for **May-2015**

	Big River #4		Leadwood South #1		Leadwood East #2		Leadwood North #3	
Sample Date	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3	**TSP** ug/m3	**Lead** ug/m3
5/1/15	37	0.039	46	0.013	invalid	invalid	38	0.007
5/4/15	80	0.014	invalid	invalid	invalid	invalid	invalid	invalid
5/5/15	50	0.020	61	0.007	22	0.014	55	0.007
5/6/15	71	0.013	89	0.013	invalid	invalid	64	0.007
5/7/15	60	0.007	85	0.007	55	0.021	65	0.000
5/8/15	21	0.007	27	0.000	24	0.007	25	0.007
5/11/15	41	0.000	38	0.000	29	0.000	40	0.000
5/12/15	35	0.007	40	0.007	41	0.000	35	0.007
5/13/15	29	0.007	29	0.020	49	0.033	29	0.013
5/14/15	38	0.007	41	0.007	37	0.007	27	0.000
5/15/15	21	0.000	27	0.000	20	0.000	invalid	invalid
5/18/15	27	0.007	30	0.007	26	0.000	28	0.000
5/19/15	25	0.007	28	0.013	24	0.014	22	0.007
5/20/15	9	0.000	12	0.007	12	0.000	11	0.007
5/21/15	12	0.007	15	0.007	17	0.000	13	0.000
5/22/15	27	0.013	23	0.007	23	0.007	23	0.007
5/26/15	13	0.000	21	0.000	18	0.007	15	0.000
5/27/15	23	0.014	21	0.007	23	0.007	20	0.007
5/28/15	19	0.007	21	0.000	18	0.007	17	0.000
5/29/15	18	0.007	20	0.000	25	0.007	18	0.000

Monthly Avg. TSP	33	35	27	30
Monthly Avg. Pb	0.009	0.006	0.008	0.004
Apr-15	0.035	0.011	0.013	0.006
Mar-15	0.004	0.020	0.013	0.005
Rolling 3-Month	**0.016**	**0.012**	**0.011**	**0.005**

Three month rolling average must be less than 0.15 ug/m3

NOTES:

Leadwood South #1: <23hr run time.
Leadwood East #2: 5/1, >25hr, 5/4, <23hr, 5/6, <23hr - bad motor brushes.
Leadwood North #3: 5/4 and 5/21, <23hr run time.

	Big River QA	
Sample Date	**TSP** ug/m3	**Lead** ug/m3
5/5/15	56	0.014
5/7/15	63	0.007
5/12/15	37	0.007
5/14/15	40	0.007
5/19/15	24	0.007
5/21/15	12	0.007
5/26/15	15	0.000
5/28/15	20	0.000

Federal Site

Sample Results for **May-2015**

Sample Date	St. Joe (Ballfields) **PM10** (ug/m3)	Big River#4 **PM10** (ug/m3)	Water Treatment **PM10** (ug/m3)
5/3/15	36	41	27
5/6/15	36	37	35
5/9/15	14	13	4
5/12/15	63	18	15
5/15/15	invalid	19	60
5/18/15	17	16	15
5/21/15	12	13	11
5/24/15	23	21	8
5/27/15	14	15	9
5/30/15	8	9	10

Compliance with NAAQS is less than 150 ug/m3

Monthly Avg. PM10	25	20	20

NOTES: St. Joe: 5/15, <23hr run time, bad motor.

Sample Date	Big River QA **PM10** (ug/m3)
5/6/15	28
5/12/15	33
5/18/15	16
5/24/15	16
5/30/15	13

Rivermines

Sample Results for **May-2015**

Sample Date	Big River #4 **PM10** (ug/m3)	Rivermines South #1 **PM10** (ug/m3)	Rivermines North #2 **PM10** (ug/m3)	Rivermines East #3 **PM10** (ug/m3)
5/3/15	41	33	30	27
5/6/15	37	35	34	35
5/9/15	13	49	16	4
5/12/15	18	20	12	15
5/15/15	19	18	18	60
5/18/15	16	32	11	15
5/21/15	13	30	11	11
5/24/15	21	19	27	8
5/27/15	15	11	7	9
5/30/15	9	7	7	10

Compliance with NAAQS is less than 150 ug/m3

Monthly Avg. PM10	20	25	17	20

NOTES:

Sample Date	Big River QA **PM10** (ug/m3)
5/6/15	28
5/12/15	33
5/18/15	16
5/24/15	16
5/30/15	13

National Site

Sample Results for **May-2015**

Sample Date	Big River #4 **PM10** (ug/m3)	Ozark #1 **PM10** (ug/m3)	Soccer Park #2 **PM10** (ug/m3)	Water Treatment **PM10** (ug/m3)
5/3/15	41	44	31	27
5/6/15	37	34	35	35
5/9/15	13	15	14	4
5/12/15	18	14	14	15
5/15/15	19	20	19	60
5/18/15	16	14	12	15
5/21/15	13	11	13	11
5/24/15	21	22	22	8
5/27/15	15	13	16	9
5/30/15	9	11	12	10

Compliance with NAAQS is less than 150 ug/m3

Monthly Avg. PM10	20	20	19	20

NOTES:

Sample Date	Big River QA **PM10** (ug/m3)
5/6/15	28
5/12/15	33
5/18/15	16
5/24/15	16
5/30/15	13

Leadwood

Sample Results for **May-2015**

Sample Date	Big River #4 **PM10** (ug/m3)	Leadwood South #1 **PM10** (ug/m3)	Leadwood East #2 **PM10** (ug/m3)	Leadwood North #3 **PM10** (ug/m3)
5/3/15	41	32	34	28
5/6/15	37	32	38	29
5/9/15	13	9	10	2
5/12/15	18	13	40	74
5/15/15	19	26	28	35
5/18/15	16	11	11	17
5/21/15	13	12	12	9
5/24/15	21	19	19	18
5/27/15	15	11	0	11
5/30/15	9	9	7	9

Compliance with NAAQS is less than 150 ug/m3

Monthly Avg. PM10	20	17	20	23

NOTES:

Sample Date	Big River QA **PM10** (ug/m3)
5/6/15	28
5/12/15	33
5/18/15	16
5/24/15	16
5/30/15	13

Meterological Data - Old Lead Belt
May-2015

24hr average

Date	Wind Speed (MPH)	Wind Direction	Sigma-Theta	Temperature (C)	Air Pressure (mmHg)	Rain (inches)	Power Supply (Volts)
01-May-15	1.8	164	38.74	11.5	748	0	13.38
02-May-15	3.5	207	28.61	17.6	746	0	13.33
03-May-15	4.9	200	23.03	21.5	745	0	13.25
04-May-15	4.3	200	21.71	22.3	747	0	13.24
05-May-15	3.7	192	23.64	22.2	749	0	13.23
06-May-15	4.9	176	21.34	22.0	746	0	13.23
07-May-15	5.5	187	21.35	22.8	745	0	13.22
08-May-15	3.4	196	24.42	21.0	744	0.85	13.25
09-May-15	2.9	170	26.11	20.0	744	0.47	13.28
10-May-15	4.3	193	27.94	20.6	744	0.29	13.26
11-May-15	3.1	228	30.18	18.2	744	0.8	13.29
12-May-15	3.5	265	28.20	13.8	751	0	13.32
13-May-15	3.1	105	31.50	15.1	753	0	13.34
14-May-15	5.2	164	25.96	18.1	748	0.11	13.32
15-May-15	4.1	193	25.29	21.3	745	0.11	13.26
16-May-15	5.5	179	24.03	21.6	745	0.1	13.26
17-May-15	5.9	194	24.57	21.9	744	0.11	13.25
18-May-15	3.4	281	32.30	23.8	747	0	13.20
19-May-15	3.7	358	28.07	15.5	749	0	13.28
20-May-15	4.3	36	28.75	10.5	747	0.13	13.42
21-May-15	3.6	315	28.06	9.8	749	0	13.44
22-May-15	1.9	220	32.78	15.6	751	0	13.35
23-May-15	3.5	160	25.53	19.8	750	0	13.27
24-May-15	6.6	173	23.91	22.1	745	0.83	13.24
25-May-15	6.3	192	24.65	23.5	744	0	13.22
26-May-15	5.6	204	24.57	21.8	743	0	13.23
27-May-15	2.5	232	34.46	21.9	746	0.41	13.23
28-May-15	3.8	174	28.02	22.3	747	0	13.22
29-May-15	3.735	178.3	30.31	22.9	745	0.17	13.21
30-May-15	3.087	316.5	35.34	20.0	744	0.78	13.26
31-May-15	4.176	358.2	22.51	14.5	747	0	13.34

INQUEST
ENVIRONMENTAL INC.

3609 Mojave Ct., Ste E ◆ COLUMBIA, MO 65202
(573) 474-8110 ◆ FAX: (573) 474-8371

March 2, 2015

Mr. Greg Henson
Chemist
The Doe Run Company
881 Main Street
Herculaneum, Missouri 63048

RE: 1st Quarter 2015 Lead/PM10 Samplers and Meteorological System Performance Audit Report.

Dear Mr. Henson,

Please find enclosed the worksheets detailing the Lead/PM10 sampler's one-point flow verifications and meteorological sensors accuracy checks that were recently performed on the Doe Run Park Hills Monitoring Network. A copy of the current certifications for the audit devices that were used has also been enclosed.

All of the verifications and checks were found to be within expected guidelines.

After reviewing the enclosed information, please feel free to call with any comments or questions. Thank you for your business.

Sincerely,

John A. Kunkel
Inquest Environmental, Inc.

PM10 Sampler Verifications

INQUEST
Environmental, Inc.

PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Leadwood (Mill St.)	Intercept (Qa)	-0.00876
Sampler	#2 PM10	Temperature	11.0 °C 284.2 °K
Flow Controller	P1018	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.057	23.80	44.45	0.942	1.127	**6.62**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.70	44.26	0.942	1.127	1.052	**-6.90**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

INQUEST
Environmental, Inc.

PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Leadwood (School)	Intercept (Qa)	-0.00876
Sampler	#3 PM10	Temperature	11.0 °C 284.2 °K
Flow Controller	P6071	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.30	1.073	23.10	43.14	0.943	1.138	**6.06**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.00	42.96	0.944	1.139	1.070	**-5.31**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

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Columbia, Missouri 65202
573-474-8110

Date	January 20, 2015	Auditor	John Kunkel		
Operator	The Doe Run Company	Transfer Orifice	1882		
Location	Park Hills Network	Slope (Qa)	1.04094		
Station	Leadwood (South)	Intercept (Qa)	-0.00876		
Sampler	#1 PM10	Temperature	11.0 °C	284.2	°K
Flow Controller	P1500	Station Pressure	30.03 "Hg	762.8	mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.057	24.00	44.82	0.941	1.125	**6.43**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.80	44.45	0.942	1.126	1.054	**-6.73**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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Volumetric Flow Control

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Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Big River	Intercept (Qa)	-0.00876
Sampler	#4 Primary PM10	Temperature	11.0 °C 284.2 °K
Flow Controller	P2952	Station Pressure	30.05 "Hg 763.3 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.057	23.90	44.64	0.942	1.113	**5.30**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.60	44.08	0.942	1.113	1.054	**-6.73**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Big River	Intercept (Qa)	-0.00876
Sampler	#4 QA PM10	Temperature	11.0 °C 284.2 °K
Flow Controller	P1019	Station Pressure	30.05 "Hg 763.3 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.30	1.073	24.40	45.57	0.940	1.124	**4.75**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
24.50	45.76	0.940	1.124	1.071	**-5.22**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Hanley Park/Crane St.	Intercept (Qa)	-0.00876
Sampler	#2 PM10	Temperature	10.0 °C 283.2 °K
Flow Controller	P2949	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.055	23.20	43.33	0.943	1.109	**5.12**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.10	43.14	0.943	1.109	1.052	**-6.90**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	St Joe Park	Intercept (Qa)	-0.00876
Sampler	#4 PM10	Temperature	10.0 °C / 283.2 °K
Flow Controller	P4353	Station Pressure	30.03 "Hg / 762.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.10	1.039	23.50	43.89	0.942	1.102	**6.06**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.60	44.08	0.942	1.102	1.035	**-8.41**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Rivermines (Wtr Plnt)	Intercept (Qa)	-0.00876
Sampler	#3 PM10	Temperature	10.0 °C 283.2 °K
Flow Controller	P2951	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.055	23.10	43.14	0.943	1.116	**5.78**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.30	43.52	0.943	1.116	1.051	**-6.99**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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Volumetric Flow Control

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Columbia, Missouri 65202
573-474-8110

Date	January 20, 2015	Auditor	John Kunkel		
Operator	The Doe Run Company	Transfer Orifice	1882		
Location	Park Hills Network	Slope (Qa)	1.04094		
Station	Rivermines (Quarry)	Intercept (Qa)	-0.00876		
Sampler	#1 PM10	Temperature	10.0 °C	283.2	°K
Flow Controller	P4601	Station Pressure	30.04 "Hg	763.0	mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.055	23.20	43.33	0.943	1.088	**3.13**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.20	43.33	0.943	1.088	1.054	**-6.73**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Rivermines (Above Quarry)	Intercept (Qa)	-0.00876
Sampler	#2 PM10	Temperature	10.0 °C 283.2 °K
Flow Controller	P4507	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.055	23.30	43.52	0.943	1.108	**5.02**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.40	43.70	0.943	1.108	1.052	**-6.90**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

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PM10 Sampler Audit
Volumetric Flow Control

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Columbia, Missouri 65202
573-474-8110

Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Ozark Insul. (National)	Intercept (Qa)	-0.00876
Sampler	#1 PM10	Temperature	10.0 °C 283.2 °K
Flow Controller	P2950	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Flow Rate Percent Difference	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.20	1.055	23.30	43.52	0.943	1.112	**5.40**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Design % Difference	Acceptable Range
23.20	43.33	0.943	1.112	1.052	**-6.90**	± 10%

Calculations:

Pressure mmHg (Pf) - ("H_2O/13.6) * 25.4

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Flow Rate Percent Difference- (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Percent Difference)/100)

Design Percent Difference- (Corrected Flow Rate-1.13)/1.13*100

Lead/TSP Sampler Verifications

INQUEST
Environmental, Inc.

Lead Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	January 20, 2015	Auditor	John Kunkel		
Operator	The Doe Run Company	Transfer Orifice	1882		
Location	Park Hills Network	Slope (Qa)	1.04094		
Station	Big River Primary	Intercept (Qa)	-0.00876		
Sampler	#4 TSP	Temperature	10.0 °C	283.2	°K
Flow Controller	P4557	Station Pressure	30.03 "Hg	762.8	mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.80	1.149	23.80	44.47	0.942	1.205	**4.87**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
24.10	45.03	0.941	1.204	**1.145**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	January 20, 2015	Auditor	John Kunkel		
Operator	The Doe Run Company	Transfer Orifice	1882		
Location	Park Hills Network	Slope (Qa)	1.04094		
Station	Big River QA	Intercept (Qa)	-0.00876		
Sampler	#4 TSP	Temperature	10.0 °C	283.2	°K
Flow Controller	P4558	Station Pressure	30.03 "Hg	762.8	mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.80	1.149	23.50	43.91	0.942	1.201	**4.53**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.60	44.09	0.942	1.201	**1.147**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

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Columbia, Missouri 65202
573-474-8110

Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Leadwood Mill St.	Intercept (Qa)	-0.00876
Sampler	#2 TSP	Temperature	11.0 °C 284.2 °K
Flow Controller	P4476	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.136	23.10	43.16	0.943	1.196	**5.28**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.10	43.16	0.943	1.196	**1.133**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
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Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Leadwood School	Intercept (Qa)	-0.00876
Sampler	#3 TSP	Temperature	11.0 °C 284.2 °K
Flow Controller	P6793	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.136	23.60	44.09	0.942	1.192	**4.93**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.50	43.91	0.942	1.192	**1.133**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

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Date	January 20, 2015	Auditor	John Kunkel		
Operator	The Doe Run Company	Transfer Orifice	1882		
Location	Park Hills Network	Slope (Qa)	1.04094		
Station	Leadwood South	Intercept (Qa)	-0.00876		
Sampler	#1 TSP	Temperature	11.0 °C	284.2	°K
Flow Controller	P4559	Station Pressure	30.04 "Hg	763.0	mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.136	23.70	44.28	0.942	1.211	**6.60**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.70	44.28	0.942	1.211	**1.131**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Lead Sampler Audit
Volumetric Flow Control

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Columbia, Missouri 65202
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Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	St Joe Park	Intercept (Qa)	-0.00876
Sampler	#4 TSP	Temperature	10.0 °C 283.2 °K
Flow Controller	P6792	Station Pressure	30.03 "Hg 762.8 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.134	23.20	43.35	0.943	1.198	**5.64**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.30	43.53	0.943	1.198	**1.130**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

INQUEST
Environmental, Inc.

Lead Sampler Audit
Volumetric Flow Control

3609 Mojave Court, Suite E
Columbia, Missouri 65202
573-474-8110

Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Hanley Park (National)	Intercept (Qa)	-0.00876
Sampler	#2 TSP	Temperature	10.0 °C 283.2 °K
Flow Controller	P4474	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.60	1.119	23.40	43.72	0.943	1.189	**6.26**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.60	44.09	0.942	1.187	**1.113**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Rivermines (Water Plant)	Intercept (Qa)	-0.00876
Sampler	TSP	Temperature	10.0 °C 283.2 °K
Flow Controller	P4475	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.134	23.20	43.35	0.943	1.195	**5.38**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.20	43.35	0.943	1.195	**1.131**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Rivermines (Quarry)	Intercept (Qa)	-0.00876
Sampler	#1 TSP	Temperature	10.0 °C 283.2 °K
Flow Controller	P2940	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.60	1.119	23.90	44.65	0.941	1.197	**6.97**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.90	44.65	0.941	1.197	**1.114**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Volumetric Flow Control

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Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Rivermines (Above Quarry)	Intercept (Qa)	-0.00876
Sampler	#2 TSP	Temperature	10.0 °C 283.2 °K
Flow Controller	P2941	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.70	1.134	23.70	44.28	0.942	1.200	**5.82**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
23.60	44.09	0.942	1.200	**1.130**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

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Date	January 20, 2015	Auditor	John Kunkel
Operator	The Doe Run Company	Transfer Orifice	1882
Location	Park Hills Network	Slope (Qa)	1.04094
Station	Ozark Insul (National)	Intercept (Qa)	-0.00876
Sampler	#1 TSP	Temperature	10.0 °C 283.2 °K
Flow Controller	P2939	Station Pressure	30.04 "Hg 763.0 mmHg

Flow Rate Audit

Transfer Orifice		Sampler				Calibration Error %	Acceptable Range
Manometer "H_2O	Flow Rate m^3/min	Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min		
3.80	1.149	23.00	42.97	0.944	1.201	**4.53**	± 7%

Sampler Operating Flow Rate

Manometer "H_2O	Pressure (Pf)	Press. Ratio (Po/Pa)	Flow Rate m^3/min	Corrected Flow Rate	Acceptable Range
22.90	42.78	0.944	1.204	**1.150**	1.10 - 1.70

Calculations:

Pressure mmHg (Pf) - "H_2O * 1.86832

Pressure Ratio (Po/Pa) - 1-Pf/Pa

Orifice Flow Rate (Qa) - 1/Slope*(Sqrt("H2O*(Ta/Pa))-Intercept)

Sampler Flow Rate (Qa) - Taken from the look-up tables

Calibration Error - (Sampler Flow-Orifice Flow)/Orifice Flow*100

Corrected Flow Rate - Operating Flow*((100-Calibration Error)/100)

Calibration Orifice Certification Worksheet

TISCH Environmental

TISCH ENVIRONMENTAL, INC.
145 SOUTH MIAMI AVE
VILLAGE OF CLEVES, OH
45002
513.467.9000
877.263.7610 TOLL FREE
513.467.9009 FAX

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5028A

Date - Jan 13, 2015 Rootsmeter S/N 9833620 Ta (K) - 292
Operator Tisch Orifice I.D. - 1882 Pa (mm) - 765.81

PLATE OR VDC #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORFICE DIFF H2O (in.)
1	NA	NA	1.00	1.3360	4.3	1.50
2	NA	NA	1.00	1.0560	6.8	2.50
3	NA	NA	1.00	0.9570	8.2	3.00
4	NA	NA	1.00	0.8870	9.5	3.50
5	NA	NA	1.00	0.6670	16.5	6.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)		Va	(x axis) Qa	(y axis)
1.0225	0.7654	1.2420		0.9943	0.7443	0.7563
1.0191	0.9651	1.6034		0.9910	0.9385	0.9763
1.0173	1.0630	1.7564		0.9892	1.0337	1.0695
1.0155	1.1449	1.8972		0.9875	1.1133	1.1552
1.0061	1.5084	2.4840		0.9784	1.4668	1.5125
Qstd slope (m) =		1.66236		Qa slope (m) =		1.04094
intercept (b) =		-0.01438		intercept (b) =		-0.00676
coefficient (r) =		0.99927		coefficient (r) =		0.99927
y axis = SQRT[H2O(Pa/760)(298/Ta)]				y axis = SQRT[H2O(Ta/Pa)]		

CALCULATIONS

Vstd = Diff. Vol[(Pa-Diff. Hg)/760](298/Ta)
Qstd = Vstd/Time

Va = Diff Vol [(Pa-Diff Hg)/Pa]
Qa = Va/Time

For subsequent flow rate calculations:

Qstd = 1/m{[SQRT(H2O(Pa/760)(298/Ta))]- b}
Qa = 1/m{[SQRT H2O(Ta/Pa)]- b}

Meteorological Sensor's Accuracy Checks

Inquest Environmental, Inc.
Wind Direction Sensor Performance Audit

Operator	The Doe Run Co	Date	01/15/2015
Location	Big River	Start Time	07:45
Station Name	Meteorological System	Stop Time	08:45
Technician	J Kunkel / M Kunkel		
		Station Declination	1.1 Deg
Sensor Mfg	RM Young	Measured Angle	180.0 Deg
Sensor Model	Wind Monitor AQ	Corrected Angle	181.1 Deg
Serial Number	128618	Alignment Error	-1.1 Deg
Sensor Height	10.0 Meters		

Vane Angle	Data Logger	Results	
		Difference	Total Error
Degrees	Degrees	± 3 Deg Limit	± 5 Deg Limit
0/360	0.9	0.9	-0.2
90	90.4	0.4	-0.7
180	180.5	0.5	-0.6
270	271.4	1.4	0.3

Average Difference (Degrees)	0.8
Average Total Error (Degrees)	-0.3

Audit Device	Wind Vane Alignment	Direction
Type	Pocket Transit	Vane Angle Fixture
Mfg.	Brunton	R.M. Young
Model	5008	18212
Serial No.	5080304492	None

Comments: Wind direction was verified by determining the orientation of the sensor in respect to True North. This was measured using a tri-pod mounted transit aligned along the length of the sensor while locked from rotating. A magnetic declination of 1.1 degrees was used to determine True North. The linearity of the sensor was determined by aligning the sensor to an indexed test fixture provided by the manufacturer. The four cardinal directions were verified using the fixture. No adjustments were made to the sensor.

Inquest Environmental, Inc.
Wind Speed Sensor Performance Audit

Operator: The Doe Run Co
Location: Big River
Station Name: Meteorological System
Auditor(s): J Kunkel / M Kunkel

Date: 01/15/2015
Start Time: 07:45
Stop Time: 08:45

Sensor Mfg: RM Young
Sensor Model: Wind Monitor AQ
Serial Number: 128618
Sensor Height: 10.0 Meters

Audit Standard		DAS Response		Limit
RPM	M/S	M/S	Difference	M/S
Zero	0.00	0.00	0.00	0.25
300	1.54	1.53	-0.01	0.25
600	3.07	3.07	0.00	0.25
1200	6.14	6.14	0.00	0.56
1800	9.22	9.22	0.00	0.71
3600	18.43	18.44	0.01	1.17
5400	27.65	27.63	-0.02	1.63
7200	36.86	36.85	-0.01	2.09
Average			0.00	

± (0.25 m/s + 5%)

Audit Device	Anemometer Drive
Type	Variable Speed
Mfg.	R.M. Young
Model	18801
Serial No.	CAO1631

Comments: Wind speed was verified using a variable speed anemometer drive. The propellor was removed from the sensor and the drive was connected using a flexible connector. The sensor was then rotated in the appropiate direction at several different speeds. Sensor responses were taken from the data logger. No adjustments were made to the sensor.

Inquest Environmental, Inc.
Temperature Sensor Performance Audit

Operator: The Doe Run Co
Location: Big River
Station Name: Meteorological System
Technician: J Kunkel / M Kunkel

Date: 01/15/2015
Start Time: 07:45
Stop Time: 08:45

Sensor Information

Sensor Mfg: Climatronics
Sensor Model: NA
Serial Number: NA
Sensor Height: 2 meters

Audit Device °C	Sensor	
	Data Logger °C	Difference °C
-0.8	-0.9	-0.1
29.1	29.0	-0.1
55.9	55.7	-0.2
	Average	-0.1

Note: The limit for each point is +/- 0.5 °C

Audit Device	
Type	Digital Thermometer
Mfg.	Control Company
Model	15-077-8
Serial No.	221381404

Comments: The temperature is verified by co-locating the sensor with a certified digital thermometer. The verification is conducted at three levels using two water baths (iced and hot water) and the ambient temperature. The sensor error was determined by comparing the sensor's data logger response to the display on the certified digital thermometer. No adjustments were made to the sensor.

Inquest Environmental, Inc.

Barometric Pressure Sensor Performance Audit

Operator: The Doe Run Co
Location: Big River
Station Name: Meteorological System
Technician: J Kunkel / M Kunkel

Date: 01/15/2015
Start Time: 07:45
Stop Time: 08:45

Sensor Mfg: Setra
Sensor Model: 276
Serial Number: 2626447

Audit Device	Data Logger Response	
mm HG	BP mm HG	Difference mm HG
747.10	750.40	3.30

Note: Limit is +/- 7.5 mm HG.

Audit Device	
Type	Digital Barometer
Mfg.	AIR
Model	AIR-HB-1A
Serial No.	6G3745

Comments: The barometric pressure is verified by co-locating the sensor with a certified digital barometer. The verification was conducted at one level after allowing the sensor and calibration device ample time to stabilize. The sensor error was determined by comparing the sensor's data logger response to the display on the certified digital barometer. No adjustments were made to the sensor.

Inquest Environmental, Inc.

Precipitation Gauge Performance Audit

Operator: The Doe Run Co
Location: Big River
Station Name: Meteorological System
Technician: J Kunkel / M Kunkel

Date: 01/15/2015
Start Time: 07:45
Stop Time: 08:45

Sensor Mfg: Texas Electronics
Sensor Model: TR525I
Serial Number: 36611-805
Diameter (inches): 6.00

Audit Device	Data Logger Response	
Known Tips	Gauge Tips	Difference %
96.00	93.00	-3.13

Note: Limit is +/- 10%.

Audit Device	
Type	Graduated Beaker
Mfg.	Texas Instruments
Model	FC-525
Serial No.	NA

Comments: The precipitation gauge output was verified using a field calibration kit supplied by the manufacturer. The kit consists of a graduated beaker and a calibration funnel using a precision orifice at the water outlet. Water was measured in the beaker and poured into the funnel while mounted on the gauge. The amount of precipitation recorded by the data logger was then compared to the known amount of water passing through the funnel. 100 tips equals one inch of rainfall. The gauge was cleaned and no adjustments were made.

Meteorological Audit Devices Certifications

BRUNTON OUTDOOR GROUP

CERTIFICATE OF CALIBRATION

Equipment Owner

Name: Inquest Environmental Mitch Kunkel

Address: 3609 Majeve Court, Ste E

Columbia MO 65203

Calibration traceable to the National institute of Standards and Technology in accordance with MIL-STD-45662A has been accomplish on the instrument listed below by comparison with standards maintained by the Brunton Outdoor Group. The accuracy and stability of all standards maintained by the Brunton Outdoor Group are traceable to national standards maintained by the National Institute of Standards and Technology in Washington, D.C. and Boulder, CO. Completed record of all work preformed is maintained by the Brunton Outdoor Group and is available for inspection upon request.

This unit has been calibrated to Lietz TM10E serial number 30937 traceable to N.B.S. Number 738227675 this July Day 30 20 14.

Description Pocket Transit

Purchase Order 256430329

Order Number 50-070367

Model Number F-5008

Serial Number 5080304492

Calibration Date 7/30/14

Recalibration Date 7/30/15

Signed Eddie Quigley 7/30/14

Quality Control Coordinator

CERTIFICATE OF CALIBRATION AND TESTING

MODEL: **18801** (Comprised of Models 18820 Control Unit & 18830 Motor Assembly)
SERIAL NUMBER: CA0163I

R. M. Young Company certifies that the above equipment was inspected and calibrated prior to shipment in accordance with established manufacturing and testing procedures. Standards established by R.M. Young Company for calibrating the measuring and test equipment used in controlling product quality are traceable to the National Institute of Standards and Technology.

Nominal Motor Rpm	Output Frequency Hz (1)	Calculated Rpm (2)	Indicated Rpm (3)
600	320	600	600
1200	640	1200	1200
2400	1280	2400	2400
4200	2240	4200	4200
6,000	3200	6000	6000
8,100	4320	8100	8100
9,900	5280	9900	9900
☒ Clockwise and Counterclockwise rotation verified			

(1) Measured at the optical encoder output.
(2) Frequency output produces 32 pulses per revolution of motor shaft.
(3) Indicated on the Control Unit LCD display.

* Indicates out of tolerance

☒ No Calibration Adjustments Required ☐ As Found ☐ As Left

Traceable frequency meter used in calibration Model: DP5740 SN: 4863

Date of inspection 10 Dec. 2014
Inspection Interval One Year

Tested By EC

Calibration
Certificate No. 1750.01

Calibration complies with ISO/IEC 17025, ANSI/NCSL Z540-1, and 9001

Cert. No.: 4000-5872220

Traceable® Certificate of Calibration for Digital Thermometer

Cust ID:Inquest Environmental Inc., 3609 Mojave Ct. Suite E, Attn. Mitchell Kunkel, Columbia, MO 65202 U.S.A. (RMA:986002)

Instrument Identification:

Model Numbers: 15-077-8, FB50266, 245BY S/N: 221381404 Manufacturer: Control Company

Model: 15-077-7 S/N: 51202300

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Temperature Calibration Bath TC-179	A45240		
Thermistor Module	A17118	2/24/15	1000351744
Temperature Probe	128	3/12/15	15-CJ73J-4-1
Temperature Calibration Bath TC-218	A73332		
Thermistor Module	A27129	10/25/14	1000346002
Temperature Probe	5202	11/30/14	15-B15PW-1-1
Temperature Calibration Bath TC-256	B01375		
Thermistor Module	A27129	10/25/14	1000346002
Temperature Probe	5267	10/19/15	15-CD5J7-1-1

Certificate Information:

Technician: 68 Procedure: CAL-06 Cal Date: 4/14/14 **Cal Due: 4/14/15**

Test Conditions: 22.5°C 50.0 %RH 1007 mBar

Calibration Data:

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
°C	0.000	0.106	N	0.000	-0.001	Y	-0.050	0.050	0.013	3.8:1
°C	25.001	25.097	N	25.001	24.999	Y	24.951	25.051	0.023	2.2:1
°C	60.000	60.103	N	60.000	60.000	Y	59.950	60.050	0.014	3.6:1
°C	100.004	100.082	N	100.004	99.997	Y	99.954	100.054	0.018	2.8:1

This Instrument was calibrated using Instruments Traceable to National Institute of Standards and Technology.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

Nominal=Standard's Reading; As Left=Instrument's Reading; In Tol=In Tolerance; Min/Max=Acceptance Range; ±U=Expanded Measurement Uncertainty; TUR=Test Uncertainty Ratio; Accuracy=±(Max-Min)/2; Min = As Left Nominal(Rounded) - Tolerance; Max = As Left Nominal(Rounded) + Tolerance; Date=MM/DD/YY

Nicol Rodriguez, Quality Manager

Aaron Judice, Technical Manager

Maintaining Accuracy:

In our opinion once calibrated your Digital Thermometer should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Digital Thermometers change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company

CONTROL COMPANY 4455 Rex Road Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

Control Company is an ISO 17025:2005 Calibration Laboratory Accredited by (A2LA) American Association for Laboratory Accreditation, Certificate No. 1750.01
Control Company is ISO 9001:2008 Quality Certified by (DNV) Det Norske Veritas, Certificate No. CERT-01805-2006-AQ-HOU-RvA.
International Laboratory Accreditation Cooperation (ILAC) - Multilateral Recognition Arrangement (MRA).

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HASS INSTRUMENT CORPORATION
6711 OLD BRANCH AVENUE • CAMP SPRINGS, MD 20748-6990 • (301) 449-5454 • FAX (301) 449-5455

C A L I B R A T I O N R E P O R T

BAROMETER/ALTIMETER
AIR Model AIR-HB-1A
Serial No. 6G3745

TEST POINT	TEST PRESSURE	DIGITAL READOUT	READOUT ERROR	CORRECTION REQUIRED
1	930.00	931.9	+1.9	-1.9
2	970.00	971.9	+1.9	-1.9
3	1010.00	1012.0	+2.0	-2.0
4	1050.00	1051.9	+1.9	-1.9
5	1018.01	1019.9	+1.9	-1.9

NOTES:

1. All data are in Millibars (hPA) and were taken at 75 F (24 C).
2. To correct the Digital Readout of the instrument, either algebraically add the CORRECTION REQUIRED to, or algebraically subtract the READOUT ERROR from, the readout shown on the instrument.
3. The TEST PRESSURE was generated using Type A-1 Barometer S/N 3327, and was approached in an increasing-pressure direction.
4. The TEST PRESSURE for TEST POINT 5 was ambient atmospheric pressure.
5. The BAROMETER/ALTIMETER was horizontal during the calibration.
6. The LCD screen of the BAROMETER/ALTIMETER has some trash in the center of the display, but it does not interfer with the readout.
7. Although the Digital Readout of the instrument can be adjusted to incorporate the average CORRECTION REQUIRED, this has not been done.

Calibration Date: 5 February 2014

By: Bernard I. Hass
Bernard I. Hass

(SEAL)